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IN THE UNITED STATES PATENT &TRADEMARK OFFICE

RE:
Application Ser.No.10/050,712
Filed: 01/18/2002
Inventor: GLYNN, Donald R.
Title: System for Separating Oil from Water.

Examiner: Krishnan S. Menon
Art Unit 1723

May 12, 2004

DECLARATION

I, Donald R,Glynn, a Canadian citizen residing in Toronto, Ontario, Canada, hereby Declare and state that:

1. I am the above named inventor of the subject Application;

2. My experience in the field of treating oily waste water is set forth in the accompanying curricula vitae, which includes my education and employment in the period 1990 – to-date.

3. Speaking as a specialist in the proven, commercial utilization of single-element cross-flow filters, as evidenced in the penultimate paragraph of my curricula vitae, and with widespread background experience in other types of waste-water filter treatment, I wish to make the following observations concerning the technical relevance and feasibility of combining prior art filter systems in the fashion suggested by the Examiner, in his Report of 02/18/2004.

4. In Paragraph 1 of the Detailed Action Claims 12, 14 and 15 are rejected as being unpatentable over Trulson (US 3,977,967) in view of Haney (US 6,099,733).

Trulson exemplifies the traditional approach of using large, multi-bundles of ceramic filter elements (see his Figures 2 and 4). In contrast, the module of the subject application comprises a single filter element located in a close-fitting filter housing, with

a very close-tolerance radial clearance between the stainless steel housing wall and the outer surface of the ceramic element, serving as the permeate drainage space. This surface-to-surface clearance distance of a subject module typically averages two millimeters, i.e. 0.07874 inches.

I am unaware of anyone else who custom fabricates their filter housings to anything approaching these close tolerances, because no one else appears to recognize just how important a role may be played by this small (annular) permeate space.

In the presently disclosed process and apparatus, this minimal permeate space serves also to contain the chemical cleaning solution/solutions, used during the subject back pulse chemical cleaning regimes (see page 6, lines 16-20 of the specification).

It is very important to keep this space volume low due to the fact that less chemical solution is needed to fill this space and the heat-up time is correspondingly less, due to the smaller volume of chemical solution to heat. This small permeate space provision is one of the key factors that makes the subject process a practical reality, enabling the reliable and effective use of modules containing a single filter element, with concomitant savings in size, space, capital and also cleaning chemicals.

Nowhere, in any of the prior art presently cited is there any mention of the need for a small annular or permeate space in the module used so as to assist in the chemical solution back-pulse cleaning of the filter membrane. The small size of the permeate/cleaning-chemical annular space makes feasible, economical, rapid and practical the requisite frequent cleaning cycles on which effective operation of the system is predicated.

5. Combining Haney with Trulson does not in any way address this structural deficiency

in the prior art, which renders it totally unsuitable for the required use.

Figures 25 and 29 of Haney show the typical arrangement of a rolled up plastic reverse osmosis filter bundle, which bears no relation to the rigid sintered ceramic membrane elements used in the present invention.

Haney is directed to entirely different subject matter. Haney (Col. 1, Lines 6-8) states; "the patent invention relates to water treatment systems of the type utilizing reverse osmosis and/or nanofiltration thin film membrane separation technology."

The pore size difference between the Haney invention and the subject application is comparable to the pore size difference between this invention and a paper coffee filter.

Haney invention (pore size)	.0001 to .001	micron	(plastic)
Present invention (pore size)	.01 to .1	micron	(ceramic)
Coffee filter (pore size)	10 to 100	micron	(paper)

Filtering in the reverse osmosis (nanofiltration) ranges utilizes membranes whose pore sizes are on average two factors of ten smaller then Ultra Filtrations (UF) of the present invention. Paper coffee filter pore sizes are on average 2 to 3 factors of ten larger than the subject ultra-filtration pore sizes.

We cannot substitute a paper coffee filter in place of our sintered ceramic ultra-filter membranes for oily wastewater treatment nor we can substitute Haney's plastic filter membranes for the same purpose. They will not work, on a number of levels.

Haney does not teach but rather cites prior art when he illustrates the use of chemical cleaning solutions used to clean nanofiltration (reverse osmosis) membranes. (Col. 6, Lines 18-23) Furthermore chemical cleaning is carefully avoided in the Haney invention. Haney states (Col. 6, Lines 31-37):

"The currently available conventional membrane separator apparatus have many undesirable characteristics. Of these undesirable characteristics, the most undesirable are: a) the low life expectancy of membrane separators operated in the conventional manner due to chemical cleaning requirements and pre-treatment failures"

If Haney in fact did use chemical cleaning of membranes in his invention he would experience, by his own admission "low life expectancy" of the filter membrane due to chemical cleaning solution attack on the (plastic) membrane surfaces. The ceramic membranes of the present invention stand up to aggressively hot chemical solution cleaning. This is one of the main reasons we tried and rejected plastic filter membranes in the early days of our research. They do not stand up to chemical cleaning and furthermore when fouled with free oils (as opposed to emulsified oils) polymer (plastic) membranes become unrecoverable and thereafter rendered unusable. Non-emulsified liquid oils must be kept away from plastic membrane surfaces at all times otherwise these types of filter elements are rendered unusable. In a real-world industrial treatment system this is extremely difficult to sustain, as free oils (tramp oils) are almost always floating on waste emulsified oily waters and either through oversight or operator error will on occasion contact the membrane surfaces. Plant shut down and costly repairs are the end result when using plastic membranes. An automated stand-alone system such as the present invention could never be based on plastic membranes. They are finicky and unforgiving. Anyone who has operated plastic membranes in the treatment of waste oily waters using Koch TM brand or similar plastic membrane systems will have tales of woe regarding the above.

Any filter membrane's flux flow rate degrades while in operation, however the ceramic

membranes integral to our invention, upon chemical cleaning after fouling, will recover normal operation flux flow. Our back-pulsed chemical cleaning solutions will even recover a membrane that has become fully fouled due to tramp oil (free oil) contamination. RO and UF plastic membranes are incapable of this feat. Their fate after free oil fouling is – disposal to the local landfill. Furthermore the recited structure of our filter modules enables the present process to operate in a fully automated fashion, to "recover" our ceramics filters, and restore them to acceptable flux flow rates. Back-pulsed chemical cleaning and the means by which the various solutions are administered, through automated valves/PLC controllers are at the core of our invention.

We do not avoid chemical cleaning, as does Haney, we embrace it.

The matter of routinely discarding a filter element, which from my own experience is an imperative aspect of Haney, if used for oily water filtration, constitutes a totally unacceptable practice for a subject apparatus, intended for remote, automatic operation.

6. Regarding the plurality of cleaning solution tanks. Haney teaches only one, non-chemical tank on the permeate side in back-flush mode. Referring to Haney (Col. 19, Lines 29-39)

"This is done to **force** water through the membranes in a direction opposite to normal flow, thereby cleaning the membrane separators 106 by removing particulate material built up on the membranes which can not be removed by merely flushing the membranes. This cleaning method **removes the need for chemical cleaning** of the membrane separators." **[emphesis** added]

Again Haney states that this reverse flow of treatment water "removes the need for chemical cleaning of the membrane(s)." This is done as stated earlier by Haney and

understood by those using plastic membranes in R.O applications to avoid the destruction of their membranes by the use of cleaning solutions.

7. Ceramic UF membranes will stand up to aggressive chemical treatment and most manufacturers of ceramic membranes provide literature advising the use of a range of chemical cleaning agents **that are re-circulated within the ring as the preferred traditional approach**. The manufacturers of ceramic membranes do not however recommend back pulsing of hot chemical solutions, as taught in the present invention, **but treat only with re-circulation of cleaning solutions <u>around the ring</u>**.

One aspect of the successful back-pulsing of hot chemical cleaning agents in accordance with the present invention is the adoption of filter modules containing a single filter element in close fitting relation with the enclosing housing, to provide a small permeate drainage space, which space serves also to contain the cleaning chemical, when it is being administered.

8. Haney's references to accumulator tank storage means (Fig. 2 #24) and inverse flow pump means (Fig. 2 #25) provides only for the pumping of produced water backwards through the membrane. No side connections to chemical storage means or delivery systems are shown or suggested in the text.

Haney (Col. 31, Lines 9-32) refers to his water back-flushing process - "replaces damaging chemical cleaning of the membrane separators." Clearly Haney's invention at all times tries to avoid chemical cleaning.

It is my experience, in this, my area of expertise, that back-pulsing of permeate waters for the purpose of cleaning gives only moderate and temporary improvement. Consequently this approach was abandoned by me and my organization long ago.

9. The examiner states, in his reason for rejecting the present plurality of tanks and automatically controlled back-pulsed cleaning solutions that "Haney teaches only one tank in the permeate side in back flush mode, and water is the cleaning solution".

It is very evident that Haney's back-flushing with water is in no way an equivalent to the presently taught aggressive use of back-flushing with hot chemicals.

It may well be asked, if water is such a great cleaning solution why does anyone ever use detergents for cleaning purposes, either industrially or domestically. Clearly the presently taught approach, of using an aggressive industrial parts washing detergent at elevated temperature, back-pulsed through a ceramic membrane, will clean oily residue off the membrane surface far better than Haney's ambient-temperature back-pulsed water. This should be readily evident to anyone, regardless of technical background; and the important role played by the presently claimed apparatus to enable and facilitate the process of separating water from oily water should be equally evident.

Furthermore the present invention employs a range of cleaning solutions, not being restricted to just detergent solutions. This also is reflected in the claimed multi-tank apparatus subject matter.

10. It should be further noted that Haney does not teach any means to raise the temperature of his back-pulsed water. It is well recognized that solvent activity is greater at elevated temperatures, yet Haney does not see fit to heat his back-pulsed water. Why? Simply put, Haney is not using solvent-action cleaning methodology. He is only using the physical brute push of the water to clean his membranes. This is out-of-date technology as it relates to the present invention and area of interest, while yet possibly retaining its place and value in Haney's field of water purification.

Again, in the matter of heating the subject solvents, the physical limitation of the size of the permeate space plays a significant role in the efficient utilization of the separation apparatus., on all aspects of which the cited prior art is silent in terms of both structure and function. The restricted volume of cleaning chemical is readily and rapidly heated.

.12. Quoting Haney (Col 6, lines 18-23): "optional membrane chemical feed tanks "L" are sometimes included as clean-in-place additions within a conventional membrane separator design, to provide for the chemical cleaning of the membrane separator(s) once they have become fouled or coated".

However, there is no teaching, as in the manner of the present invention, as to what chemicals are used, or how they are applied, or dealt with. Nor is there any mention of heating of the chemicals. These aspects of the handling and utilization of the cleaning chemical solutions are all dealt with in the present invention, where in-situ cleaning is the modus operandi.

Relating the foregoing process elements of the present invention to the subject apparatus claims under consideration, the case has been clearly set forth above, that the process capability is profoundly influenced by the physical characteristics of the filter module, as now recited.

13. Concerning Claims 14 and 15, the filter module as taught by Trulson is the traditional approach of using large, multi-bundles of ceramic filter elements (see his Figures 2 and 4). Trulson is silent concerning the all-important module spatial limitations set forth in Claim 12, from which Claims 14 and 15 depend. The physical characteristics

set forth in Claims 14 and 15 are of profound significance in the operational efficacy of the process, as taught in the subject application, and which, taken in combination with Claim 12, clearly differentiate over Trulson's apparatus.

Regarding Claim 15, no mention is made of a double seal arrangement in any of the patents sighted. Because of the pressures and solution velocity utilized when back pulsing chemical cleaning solutions, a double O-ring seal assembly is highly desirable, to avoid cleaning solutions present in the permeate space from directly entering the re-circulation ring volume space, made possible by the dislodging of a single O-ring seal. More importantly, when the processor is put back in service after cleaning with chemical solutions a dislodged single O-ring seal would permit waste oily waters to pass directly to the permeate (treated) water side of the processor. We discovered that single O-ring seals can become dislodged when cleaning solutions are back-pulsed in the manner of our invention. One might wonder why we would engineer and build such a ceramic filter sealing device if there were no need. Since the examiner has cited no earlier showing of multiple ring end seals, the claimed novelty of this arrangement appears to be justified. The practicality of this provision has been demonstrated, and its value established.

14. Concerning the Boulter reference (US5, 911,884), which is combined with Trulson and Haney, it is noteworthy that Boulter uses a cabinet and control means for a reverse osmosis water filtration system that is coin operated, and dispenses filtered drinking water to the buying public. The feed water for the Boulter invention is city tap water (and luckily not the industrial oily wastewater of the present invention). Furthermore Boulter uses reverse osmosis (plastic) membranes and not ceramic ultra-filtration membranes. Boulter, like Haney, uses molecular sieves for full-flow mass filtration and

not the (UF) cross-flow filters as in the present invention. Boulter's cabinet has no apparent relevance to the subject apparatus, nor to its venue of use, namely an industrial milieu.

15. Concerning Claim 16, Yunoki's teaching concerning air-powered back-flushing provision does not deal with a power-lost situation, to which the subject application is directed, as now recited in the amended Claim 16.

16. Concerning the subject matter of Claims 17 and 18, the present invention as defined in Claim 12 teaches an apparatus that is practical and economical for use in handling oil-contaminated waste water.Use of a cabinet-contained module in a working environment such as an auto-parts manufacturing plant offers significant practical advantages. The added capability of incorporating an additional filter module within a standard cabinet, in pivotal, back–to-back relation, correspondingly doubles the annual capacity of a system, and greatly facilitates servicing. Such characteristics are not taught in the cited prior art.

17. Bearing in mind that the Haney and Trulson apparatuses are physically totally incompatible, and incapable of being combined, the teachings of Haney and Trulson, even considered in hindsight, also entirely fail to lead one skilled in the art to the apparatus of the present invention, or to the underlying philosophy on which the subject system is based. The addition of Boulter does not remedy the evident deficiencies in the earlier teachings of the cited prior art, in relation to the present invention. Yunoki also fails in this regard.

Further, the Declarant sayeth not.

Signed at Toronto, Ontario, Canada, this 14th_ day of May, 2004 ____________

Donald R.Glynn

Curricula Vitae

Donald R.Glynn (B. Tech.)

Education

Bachelor of Technology (Photographic Systems)
Ryerson University Toronto 1977

Photographic chemistry, Photo-processing machine maintenance, Optics, Photo-microscopy, Sensitometry, Densitometry, Photo printmaking techniques.

Employment Related to the field of the Invention

Shannon Aqua-Tech Ltd.
General Manager 1990-1994

- Large-scale industrial oily wastewater treatment plant; design, build, staff.
- Processed volumes of oily wastewater to 2,000,000 liters per week.
- Designed processes using flocculating chemicals (Aluminum Sulfate, Aluminum Chloride, Polyquaternary Amine (high molecular weight) cationic polymers, Anionic polymers.)
- Large-scale filtration of flocculants carried out using Pearlite (expanded mica) and diatomaceous earth on rotary vacuum drum filter.
- Creation of analytical lab capable of fast approval of received waste.
- (Equipment: DCP Spectrophotometer, ICP Spectrophotometer, Gas Chromatograph, Micro-coulometer, Flash point test, Phenol test)
- Process tank fit-out, filter presses, rotary vacuum drum filter, treatment chemical feed systems, piping systems, marketing.

Crystal Edge Ltd.
Researcher 1995-1997

- Built prototype membrane systems for separation of oily wastewater emulsions using both polymeric (plastic hollow tube) and ceramic cross-flow filter systems.
- Filed application and received Canadian Government grant National Research Council (IRAP Program) to investigate oily wastewater treatment using cross-flow ceramic membrane filter technology.
- Construction of two non-automated ceramic membrane based oily wastewater processors.
- Laboratory work in the area of de-metalization of waste lubricating oils (crankcase oils) with the goal of creating product oils.

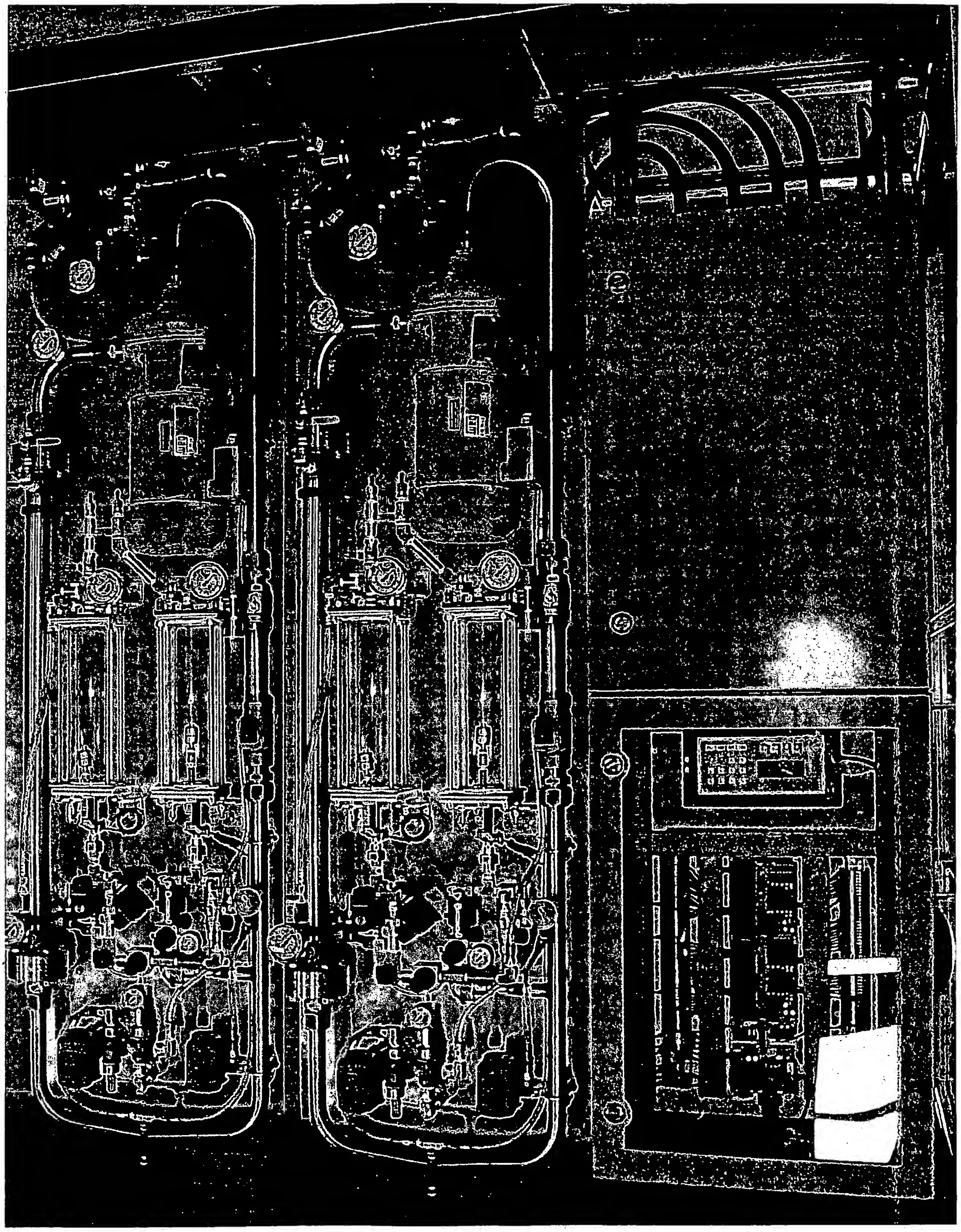
ClearSpec Process
Owner 1998-2000

- Prototyping and construction of semi-automated (non-PLC) ceramic cross-flow UF processor. Research continued on client site (auto parts manufacturer).
- Processor upgraded to full PLC control with inclusion of early heated cleaning chemical back-pulse through membrane for the first time.

ClearSpec Ltd.
Owner 2000- Present

- First commercial single-element cross-flow filter processor delivered to client (auto parts manufacturer) in Feb. 2002 to successfully treat 650,000 liters of mixed oily wastes per year. This original processor generates revenue on a continuous service contract to our company.
- Redesign and construction of new processor based on advanced back-pulsed chemical cleaning. Upgraded PLC to achieve remote monitoring and control. (attached brochure/ photos).

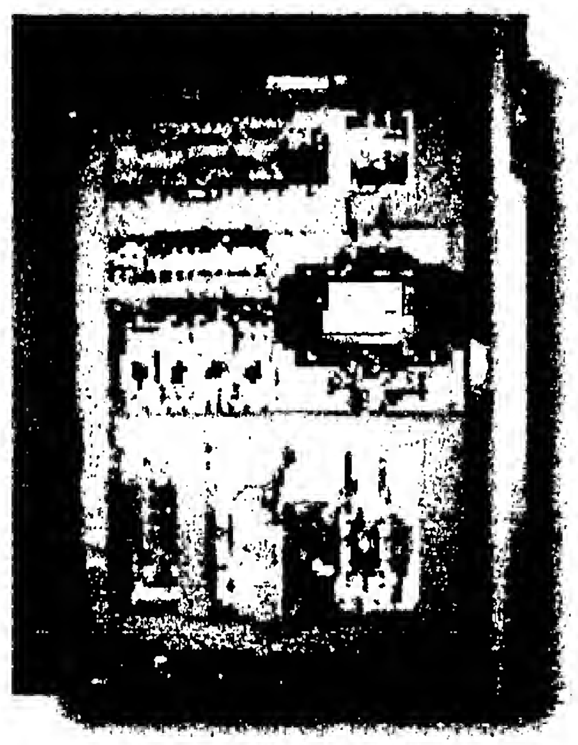
GLYNN App'n 10/050,712 ART UNIT 1723

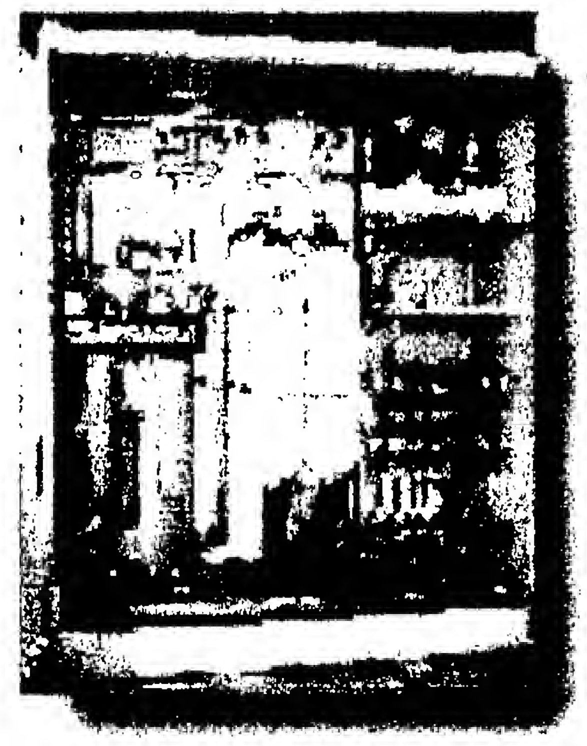


ClearSpec is a stand-alone automatic oily waste water treatment plant.

The ClearSpec unit is installed and maintained at no charge in accordance with a service contract that is billed monthly ... at about half your current cost for waste water haulage. One tankertruck per week becomes one every 4 to 6 months. ClearSpec works with your existing waste collection system; periodic independent lab analysis is done on the water that goes to drain.


Control Panel with HMI


High Voltage Panel


Maintenance and Support Section

Production Volumes

Footprint	Litres Per Year
3' x 6'	1,500,000
6' x 6'	6,000,000

ClearSpec is not ...

... a chemical process. No need to buy chemicals.

... an absorbent process. No solids disposal costs.

... an evaporation process. No large electrical bills.

ClearSpec is ...

... computer (PLC) controlled

... installed and maintained exclusively by ClearSpec professionals

... remotely monitored to ensure performance

... equipped with self-cleaning UF main filters

... capable of producing real-time and archived production data

ClearSpec

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